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LISTS OF SPECIES

Dung-beetles (Coleoptera: Scarabeidae) from the Zona Protectora Las Tablas, Talamanca, Costa Rica

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Abstract: Dung-beetle species are considered an important focal indicator group in tropical forests. During 2007, eighteen traps were set in two permanent biodiversity plots during one week surveys in Las Tablas Protected Zone within La Amistad Biosphere Reserve. The main purpose of this study was to determine the group composition and diversity as the basis for permanent monitoring and to measure potential impacts of land use change and climate change on mountain diversity. Pitfall traps were placed randomly within the plots with human feces as bait. A total of 26 species distributed in 13 genera and six tribes were collected. The composition of species includes eight endemic species, seven for Costa Rica (CR) and Panama and one only for CR. The diversity found in this study was typical of previous studies in the region. Further sampling is needed to obtain the total number of species for the area. This study is part of an on-going research project about climate change impacts and biodiversity monitoring in this important eco-region of Mesoamerica.

Introduction

Dung-beetles are important indicator species for monitoring spatial and temporal patterns of biodiversity of tropical forests (Favila and Hallfter 1997, Davis et al. 2001), where they provide important ecological benefits including being secondary dispersers, accelerating nutrient recycling rates, and increasing plant yields. They have been used extensively in biodiversity monitoring and other studies across the tropics (Mittal 1993, Andresen 1999, Perez-Ramos et al. 2007).

Dung-beetles' ecology and taxonomy has been extensively studied in Costa Rica, with numerous studies across the country and with an important collection held by the National Biodiversity Institute (Kohlmann et al. 2007). However, the species composition in mountain forests of the country is one of the least studied, including the Talamanca highlands (Kohlmann et al. 2007). Taxonomically, this group belongs to the Order Coleoptera, Family Scarabaeidae, it comprises about 5000 species worldwide including 12 tribes (Cambefort 1991). In Costa Rica 175 species have been reported, a high number compared with other biologically rich countries in the region (Kohlmann et al. 2007). Here we present one of the first species lists for dung-beetles of the Talamanca Eco-Region, focusing on Las Tablas Protected Zone (ZPLT).

Materials and Methods

Study Area

The *Cordillera de Talamanca* (Figure 1) is an eco-region located on southeastern Costa Rica, and western Panama covering a total of 667,825 ha (INBio 2007). The region is considered one of the most important protected corridors of forest in Mesoamerica and the most endemic species of eco-regions in Costa Rica (Gonzalez-Maya et al. 2008a). The eco-region is composed of protected areas, indigenous reserves, private reserves and private farms, and it includes the largest Protected Area in Costa Rica, La Amistad International Park, shared between Costa Rica and Panama. The area has been designated a Biosphere Reserve and World Heritage Site by UNESCO.

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Las Tablas is a Protected Zone in southern Costa Rica covering approximately 19,062 ha. Protected Zones are passively managed areas with restrictions on land use, but are privately owned and maintained including many farms. The zone represents an important conservation area since it is part of the Buffer Zone of La Amistad International Park. It also represents the most important forest patch in a proposed corridor to link the Talamanca Mountain Range with the Osa Peninsula, composed of three important protected areas for the country (Cespedes et al. 2007). The present study was conducted in Las Alturas del Bosque Verde, a 11,600 ha private farm with an elevation range from 1000 to 2100 masl (Gonzalez-Maya et al. 2008b). The mean annual precipitation is around 3500 mm with a mean temperature of 27 °C (INBio 2007a). All permits were granted under "general collect" for INBio.

Dung-Beetle sampling

During 2007, two permanent sampling plots for biodiversity surveys were established on an elevation gradient from 800 to 1300 m. The plots were surveyed during two months (September-October) on each sampling plot. Eighteen baited pit-fall traps (Larsen and Forsyth 2005) were set and maintained regularly during the survey period. The length of the study period was determined by the amount of time needed to obtain the alpha diversity (Spector and Forsyth 1998). The traps were baited with human feces from the same individual (Howden and Nealis 1975), which were renewed every day for continued efficacy. The traps (plastic cups) were filled with water and detergent to maintain the collected individuals in the trap.

The sample from each trap was collected and stored separately in 70% alcohol, dried and deposited in INBio collection. The identification was made by comparing with material in the INBio collection, and all the specimens were deposited there and were catalogued for future reference. All the identification was undertaken by one of the authors with the support of INBio´s curator (Angel Solis).

Basic diversity analyses were made using McIntosh Dominance Index, Shannon Diversity Index, and Jaccard Similarity Index.

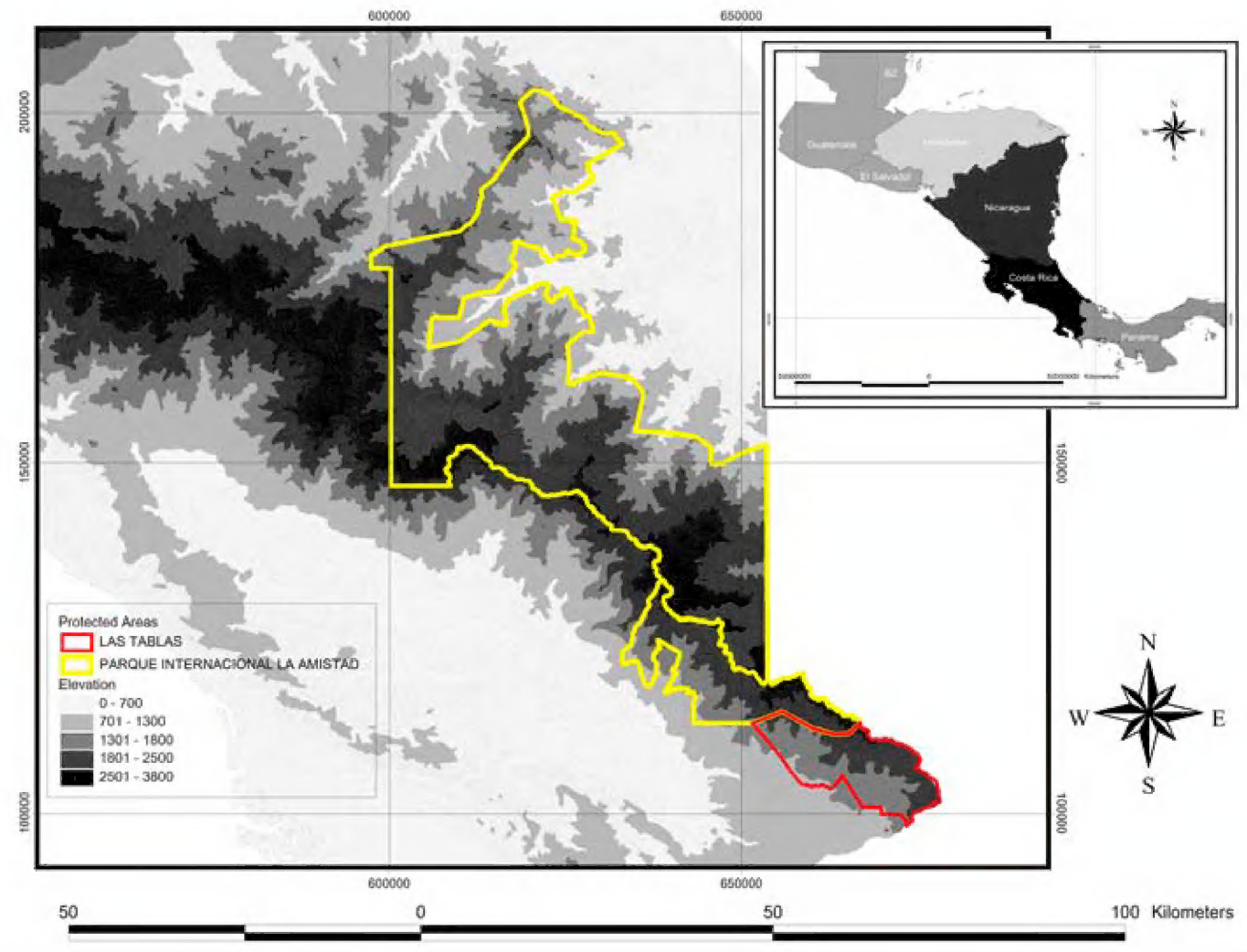

Figure 1. La Amistad Biosphere Reserve and Las Tablas Protected Zone study area, Talamanca, Costa Rica.

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Results and Discussion

A total of 26 species, representing 38% of the total number of species reported for this elevation range in the country (Kohlmann et al. 2007), and 566 specimens were collected during the entire study. All the specimens belonged to the Scarabeinae sub-family and a total of six tribes and 13 genera (Table1).

Of the total of 26 species, 8 were endemic (30.76 %), 7 shared between Costa Rica and Panama and one endemic to Costa Rica. This number represents the high endemism value of the area, and the importance for conservation and further research.

Given the level of sampling effort, the number of species as well as the total of 566 specimens is relatively high and comparable with other studies in the region conducted at lower elevations (Suatunce et al. 2004, Harvey et al. 2006).

Table1. Dung-Beetle species collected by pit-fall traps in ZPLT, Talamanca, Costa Rica.

Tribe	Species	Authority
Ateuchini	*Canthidium ardens*	Bates, 1887
	Canthidium centrale	Boucomont, 1928
	Canthidium haroldi	Preudhome de Borre, 1886
	Canthidium perceptibile	Howden & Young, 1981
	Canthidium tuberifrons	Howden & Young, 1981
	Canthidium vespertinum	Howden & Young, 1981
	Scatimus erinnyos	Kohlmann & Solís, 1997
	Uroxys depressifrons	Howden & Young, 1981
	Uroxys boneti	Pereira & Halffter
Canthonini	*Canthon hartmanni*	Howden & Gill, 1987
	Deltochilum mexicanum	Burmeister, 1848
	Deltochilum parile	Bates, 1887
	Deltochilum pseudoparile	Paulian, 1938
Coprini	*Copris costaricensis*	Gahan, 1894
	Dichotomius satanas	(Harold, 1867)
	Ontherus pseudodidymus	Génier, 1996
Eurysternini	*Eurysternus magnus*	Laporte, 1840
	Eurysternus velutinus	Bates, 1887
Onthophagini	*Onthophagus incensus*	Say, 1835
	Onthophagus inediapterus	Kohlmann & Solís, 2001
	Onthophagus nyctopus	Bates, 1887
	Onthophagus propraecellens	Howden & Gill, 1987
	Onthophagus orphnoides	Bates, 1887
Phanaeini	*Coprophanaeus chiriquensis*	(Olsoufieff, 1924)
	Phanaeus pyrois	Bates, 1887
	Sulcophanaeus velutinus	(Murray, 1856)

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Table 2. Representativeness of the collected specimens/species according to previous collections from the ZPLT deposited at INBio´s collection.

Genus	Previously reported species	Collected species	Undescribed species	Total
Canthidium	7	4	2	**13**
Canthon	0	0	0	**0**
Copris	1	1	0	**2**
Coprophanaeus	2	1	0	**3**
Deltochilum	2	1	1	**4**
Dichotomius	0	0	1	**1**
Eurysternus	1	1	0	**2**
Ontherus	1	1	0	**2**
Onthophagus	9	2	3	**14**
Phanaeus	1	1	0	**2**
Scatimus	0	0	0	**0**
Sulcophanaeus	1	1	0	**2**
Uroxys	2	2	0	**4**
Total	**27**	**15**	**7**	**49**

The representativeness of the species collected was also high, according to Atta Database (INBio database including all the specimens collected and stored at the Institute´s collection; INBio 2008) which showed that the list presented here includes the 55.5 % of the previous reported species for the area and also adds 7 species (20.5 % of the total species for the area) not reported before (Table 2).

Among the species previously reported for the area and that are not found in this study, the richest genus was *Onthophagus sp.* (7 spp.), followed by *Canthidium sp.* (3 spp.), *Deltochilum sp.* and *Coprophanaeus sp.* (1 sp. each). The absence of these species could have a number of causes, including the type of bait, as some species use different types of resources and not only dung, and the influence of wind, trap spacing, elevation among many other factors that influence the sampling and species composition obatined (Larsen and Forsyth 2005). Also, dung beetles have shown a strong relationship with seasonality and vegetation type, where rainfall regimes and forest structure can determine the composition of species (Halffter and Arellano 2002, Andresen 2005).

The newly reported species for the area include 4 genera; there are several differences among these species, varying from really common and widespread species according to literature (*C. haroldi* and *C. centrali*) to almost ecologically unknown species (*D. pseudodidymus*, *O. inediapterus* and *O. nyctopus*). The specimens also include one highly seasonal species (*D. satanas*). The most interesting case (*O. orphnoides*) is a species that is reported to feed on seeds from some species of Lauraceae (*Persea sp.*) and is not thought to feed on dung at all (Solis pers. comm.).

The distribution of abundances in the two plots showed a remarkable dominance of *Dichotomius satanas* (148 individuals), followed by *Scatimus erinnyos* (96 ind.), *Ontherus pseudodidymus* (78 ind.), and *Corpophanaeus chiriquensis* (77 ind.). There was a lower richness in the lower plot (800 m), and higher abundances in the higher one (1300 m; Figure 2). However, the McIntosh Dominance Index did not show significant differences between the two plots (D= 0.639 and 0.649 respectively). Shannon diversity indexes showed small differences among the two sites

(H′=2.23 for first plot and H′=2.17 for the second plot), and the Jaccard similarity index showed a 73.1 % similarity between the two plots at different elevations.

Conclusions

Further sampling effort is needed in the area to obtain a comprehensive pool of potential species for the area, and to understand the elevation distribution of species. However, this first list represents an important advance in the knowledge of this important group of indicator species in the region. The value of this report resides in its importance for conservation planning and as an important input to research and conservation efforts in the area. It is also one of the first efforts to catalog and measure high biodiversity of the area, and it builds the foundation for long-term monitoring in middle elevations of this eco-region.

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Literature cited

Andresen, E. 1999. Seed dispersal by monkeys and the fate of dispersed seeds in a Peruvian rain forest. Biotropica 31: 145-158

Andresen, E. 2005. Effects of season and vegetation type on community organization of Dung Beetles in a Tropical Dry Forest. Biotropica 37:291-300

Cambefort, Y. 1991. Biogeography and evolution; p. 51-67 *In* I. Hanski and Y. Cambefort (ed.), Dung Beetle Ecology. Princeton. Princeton University Press.

Céspedes, M. V., B. G. Finegan, and B. Herrera. 2007. Propuesta de una red ecológica de conservación entre la Reserva de Biosfera La Amistad y las áreas protegidas de la Península de Osa, Costa Rica. The Nature Conservancy. Boletín Técnico 1: 6 pp.

Davis, A.J., J. D. Holloway, H. Huijbregts, A. Kirk-Spriggs, and S. Sutton. 2001. Dung beetles as indicators of change in the forests of northern Borneo. Journal of Applied Ecology 38: 593-616

Favila, M. E. and G. Halffter. 1997. The use of indicator groups for measuring biodiversity as related to community structure and function. Acta Zoológica Mexicana 72: 1-25

Gonzalez-Maya, J. F., B. G. Finegan, and J. Schipper. 2008a. Densidad, uso de hábitat y presas del jaguar (Panthera onca) y el conflicto con humanos en la región de Talamanca, Costa Rica. The Nature Conservancy. Boletín Técnico 2: 7 pp.

González-Maya, J. F., B. G. Finegan, J. Schipper, and F. Casanoves. 2008b. Densidad absoluta y conservación del jaguar y sus presas en la Región de Talamanca Pacífico, Costa Rica. San José. The Nature Conservancy Technical Series. 49p.

Halffter, G. and L. Arellano. 2002. Response of dung beetle diversity to human-induced changes in a tropical landscape. Biotropica 34: 144-154

Harvey, C., J. Gonzalez, and E. Somarriba. 2006. Dung Beetle and Terrestrial Mammal Diversity in Forests, Indigenous Agroforestry Systems and Plantain Monocultures in Talamanca, Costa Rica. Biodiversity and Conservation 15: 555-585.

Howden, H. F. and V. G. Nealis. 1975. Effects of clearing in a tropical rain forest on the composition of the coprophagous scarab beetle fauna Coleoptera. Biotropica 7: 77-83

INBio. 2007a. Ficha Técnica Parque Internacional La Amistad. Document accessible at http://www.inbio.ac.cr/pila/parque_ficha_tec.htm. Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica. Captured on 20 September 2007.

INBio. 2008. Atta. Document/Database accessible at http://atta.inbio.ac.cr/. Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica. Captured on 20 September 2007.

Kohlmann, B., A. Solís, E. Ortwin, X. Soto and R. Russo. 2007. Biodiversity, conservation, and hotspot

Check List **4**(4): 458–463, 2008.
ISSN: 1809-127X

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atlas of Costa Rica: a dung beetle perspective (Coleoptera: Scarabaeidae: Scarabaeinae). Zootaxa 1457: 1–34

Larsen, T. and A. Forsyth. 2005. Trap spacing and transect design for Dung Beetle Biodiversity studies. Biotropica 37(2): 322-325

Mittal, I. C. 1993. Natural manuring and soil conditioning by dung beetles. Journal of Tropical Ecology 34:150-159

Perez-Ramos, I., T. Marañon, J. Lobo, and J. Verdu. 2007. Acorn removal and dispersal by the dung beetle *Thorectes lusitanicus*: ecological implications. Ecological Entomology 32:349–356.

Spector, S. and B. Forsyth. 1998. Indicator taxa for biodiversity assessment in the vanishing tropics. Conservation Biology Series 1:181-209.

Suatunce, P., E. Somarriba, C. Harvey, and B. Finegan. 2004. Diversidad de escarabajos estercoleros en el bosque y en cacaotales con diferente estructura y composición florística en Talamanca, Costa Rica. Agroforestería en las Américas 41-42: 37-42.

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